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The Manual Wargaming Process:
Does our Current Methodology Give Us The Optimum Solution ?

A   Monograph
by

Major   Walter   E.   Kretchik

Infantry

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ABSTRACT

THE MANUAL WARGAMING PROCESS: DOES OUR CURRENT METHOD
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pages.

This monograph analyzes the manual wargaming portion of the
U.S. Army's decision-making cycle in order to determine if the
process deduces the optimum course of action. The monograph
begins by examining game theory, which is the theoretical basis
for wargaming. This examination establishes that game theory
provides two theoretical models for decision-making, one based
upon enemy capabilities and the other on enemy intentions. The
analysis continues by examining the historical development of
wargaming and its incorporation as a decision-making tool. Using
theory-based criteria, the monograph reviews current American,
German, British, and Soviet war gaming methods at the division
level. The three criteria analyze how well a methodology pro-
vides a rational opponent, considers friendly and enemy inten-
tions, and uses rational control or rules.

The monograph concludes that the current U.S. wargaming
method does not give us the optimum solution, largely because it
is difficult to discover enemy intentions before a decision is
made by the friendly commander. If a friendly commander knew
what the enemy's intentions were, he would choose the appropriate
course of action to counter it. However, since the commander can
only base his decision on enemy capabilities--or what his enemy
can (vice will) do--his course of action choice becomes merely a
"best guess." The monograph then suggests remedies to bring us
closer to an optimum course of action.

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I. Introduction

> The increasingly complex demands made by modern forces and
> by modern warfare . . . have led to an explosion in the
> amount of data processed by any given command system to
> carry out the mission. As the quantity of data rose, the
> difficulty of interpreting it in preparation for decision-
> making grew . . . .
>
> Martin Van Creveld
> Command In War

Decision-making is a process rather than just a goal.1

Specifically, military tactical decision-making is a dynamic,

continuous cycle. In addition, decisions about current and

future operations often occur simultaneously.2

The United States Army endorses a standardized, tactical

decision-making process that serves as a methodology for guiding

tactical commanders and their staffs in the application of Air-

Land Battle doctrine. Army Field Manual 101-5, Staff Organiza-

tion and Operations, is the primary doctrinal source that

describes that decision-making process.

Within the military decision-making process is a procedural

step called the "Estimate of the Situation," which includes steps

to analyze and compare a commander's courses of action. The

decision-maker develops a course of action using the criteria of

feasiblity, suitability, and acceptability. A feasible course of

action is "doable"; it offers a reasonable expectation of suc-

cess. A suitable course of action should result in the desired

effect. Finally, an acceptable course of action means the

expected results are worth the estimated cost of executing the

course of action. After a course of action is developed, it is

analyzed using wargaming.3

Wargaming is the process of systematically thinking about

the chain of events that occur as a unit executes a course of

action. Wargaming tries to visualize the flow of a battle.

By using friendly strengths and dispositions, enemy assets,
possible friendly and enemy courses of action, and a set
piece of ground, wargaming attempts to foresee the action,
reaction, and counteraction dynamics of a battle.4

Thus, the wargamer first determines friendly actions. These

are simply any feasible friendly moves against an enemy. This

step leads to the next part of the sequence, or the enemy reac-

tion. The reaction procedure considers all moves the enemy might

make to counter the friendly move. The wargamer asks himself,

"If I do this, what can and will the enemy do?" By answering

that question, the wargamer then must move into the counteraction

step to determine answers to the question, "If he does this, what

should and can I do?"5

The tactical commander's visualization and evaluation of

courses of action through wargaming is important. To win on the

battlefield the commander must first throughly understand all the

options available to him in defeating the enemy.6 Then he must

choose a course of action from those options that will allow him

to best accomplish his mission.7

Because I am not sure that our wargaming process achieves

that end, this monograph will try to answer the question: Does

the current United States Army manual wargaming process determine

the optimum course of action for the tactical commander? I will

attempt to solve that problem by first examining the theoretical

basis for wargaming; this examination should help me determine

criteria for analyzing the current wargaming methodology. Next,
my investigation of the historical evolution of wargaming should
illustrate how and why wargaming became an accepted part of the
decision-making process. Finally, I will analyze the current
United States Army tactical decision-making process, using my
criteria, to evaluate how well we perform the wargaming process.
I will limit my inquiry to the division level due to space
limitations.

By conducting these analyses I hope to determine whether or
not our wargame process is consistent with theory. If not, I
hope to determine if this inconsistency gives us a less than
optimum solution. Simultaneously with my analysis of the U.S.
process, I will also analyze the current division level, Army
decision-making processes of Germany, Britain, and the Soviet
Union. I will attempt to discover any advantages or disadvan-
tages of their wargaming processes which might improve U.S. Army
wargaming.

Several assumptions are necessary in order to answer the
research question. First, wargaming will continue to be an inte-
gral part of the tactical decision-making process since command-
ers must have a methodology to decide which course of action is
best. A second assumption is that manual wargaming--as opposed
to automated methods--will continue to be the process of choice
at the division level. Perhaps the Army will someday field a
useful, automated wargaming system. A 1989 Army Research Insti-
tute (ARI) experiment, which compared manual versus automated
wargaming results, determined that automated means had no

significant advantages over manual processes.8

II. GAME THEORY

War gaming is a derivation of a mathematical theory known as
gaming. While this section is but a brief overview of game
theory, it is necessary to examine this theory to grasp how war
gaming originated as a decision-making tool.

Game theory is a branch of mathematics developed to deal
with conflict of interest situations in the social sciences. Its
origins go back to the mid-1920's, to articles written by Emile
Borel and John von Neumann. Von Neumann and Oskar Morgenstern
later established the field of gaming in 1953, when they pub-
lished Theory of Games and Economic Behavior. This book, hailed
as a major scientific achievement, is still the primary work in
the field.9

Game theory is not about games as most people think of them.
Game theorists define a game as any social situation involving
two or more players in which the interests of the players are
interdependent.10 According to the noted game theorist, Frank
Zagare, "While poker and parchesi are games, so are wage bargain-
ing, . . . arms races, and war."11

The crux of the von Neumann/Morgenstern theory of games is
that one player can select an optimum strategy from a number of
possibilities without knowing the strategies of the other player.
A "payoff," or the benefits accrued from a particular strategy,
may be positive, negative, or zero. Thus, given any interaction
with your opponent, you always win, lose, or draw. This concept,
known as a "zero-sum" game, means your gains equal your

opponent's losses and vice versa; if neither side gains or loses, the game ends in a draw.12

Interactive gaming, according to von Neumann and Morgenstern, needs three basic components: a rational actor, rational control, and strategies that consider the opponent's actions as well as friendly ones.13 These components will later form the basis of my criteria for evaluating the U.S. wargaming process. A **rational actor** is someone who looks out for his own interests and pursues a strategy (course of action) to achieve those interests.14 In pursuing this strategy, the rational actor opposes any move by an opponent which might prevent him from accomplishing his goal. Similarly, his rational opponent also anticipates where he might be blocked from his goal and acts to prevent this.

The rational actor concept is basic to the von Neumann/Morgenstern theory of gaming. The game cannot exist if either player is irrational. Von Neumann notes that an irrational opponent is not governed entirely by reason in reaching his decisions. An irrational opponent does not know what he wants, fails to define his goals, and does not seek the attainment of those objectives.15 Thus, there cannot be a game, if one player is not cooperating.

Von Neumann and Morgenstern define **rational control** as rules or principles to which actions or procedures must conform or intend to conform.16 While many wargaming rules can be used for decision-making, they tend to fall into one of two categories: rigid or free-form.17

Rigid games specify all rules before game start. Rigid

games include chess, poker, and other similar interactive games.
Because a finite number of moves exist for any situation, mathe-
matical analysis determines which moves provide an optimum solu-
tion under given circumstances. In chess, for example, because a
player can only move one piece per turn, his future moves can be
mathematically forecasted using probability theory.18

Free-form games, on the other hand, are loosely defined and
imaginative. They are "diplomatic" in nature; that is, consensus
frequently determines results. An example of a free-form game is
the child's game of tag. The players execute the game differ-
ently each time by varying the rules to suit the conditions.
Free-form games, according to von Neumann and Morgenstern,
closely mirror the realities of our interactive world because
these games are how actors analyze complex situations, select
strategies, and then make and implement decisions.19

The process of considering both friendly and opposing
actions is the last required component for a game. These actions
fall into either of two categories: capabilities or intentions.20

Capabilities are strategies that either you or an opponent
might take. By considering an opponent's capabilities, an actor
must consider all likely (theoretically, all possible) options
available to himself and an opponent because he is uncertain as
to which option his opponent will choose. For instance, both
players can attack, defend, withdraw, or do nothing.21

Intentions, meanwhile, are strategies that have already been
selected for execution. The decision to commit to a strategy
creates indicators that might cue an actor that his opponent has

6

made a decision to execute a strategy. The actor then formulates
a counter-strategy to stop his opponent's intended action.22

Von Neumann and Morgenstern developed two theoretical models
dealing with the process of determining strategies based upon
1) whether or not an opponent is capable of doing something (the
minorant or maxi-min game), or 2) intends to take some kind of
action (the majorant or mini-max game).23 Both theoretical mod-
els try to select a minimal-risk option from available choices,
given the time available to collect information regarding an
opponent's intentions. If an actor knows little about an oppo-
nent's intentions and must make a decision with available infor-
mation, von Neumann and Morgenstern recommend the maxi-min model.
If an actor has the time to deduce an opponent's intentions, then
von Neumann and Morgenstern suggest the mini-max model.24 Why we
use these particular decision models will be explained later in
this section.

In 1951, Colonel Oliver Haywood, USAF, wrote a RAND paper
entitled Military Doctrine of Decision and the von Neumann Theory
of Games. Haywood's paper applied von Neumann/Morgenstern's game
theory to military decision-making and became the basis for how
we perform wargaming today. Haywood deduced that a friendly
military commander equated to a rational actor because they both
establish objectives, pursue courses of action to achieve those
objectives, and block an opposing commander's attempts to keep
them from their goal. Haywood assumed, as game theory assumes,
that a rational enemy opponent behaves in a similar manner.
Therefore, Haywood concluded that any decision-making process

must consider a rational enemy opponent.25

Moreover, Haywood believed that "The Estimate of the Situation," an analytical method for military problem-solving, was identical to game theory's rational control concept. Haywood noted that the estimate process made commanders conform to an analytical method for decision-making. By conforming to an accepted decision-making process, military commanders were, in effect, following established norms. Thus, Haywood concluded that the estimate process equates to von Neumann/Morgenstern's rational control criterion because it establishes rules.26

Furthermore, Haywood believed that a commander seeking a decision wants a course of action (von Neumann/Morgenstern's "strategy") that has more advantages than disadvantages with respect to the enemy's ability to oppose it. In the example in Figure 1, Haywood used the von Neumann/Morgenstern maxi-min model to develop a sample matrix based upon enemy capabilities:

Figure 1

ENEMY COURSES OF ACTION

FRIENDLY COA	I	II	III	MINIMUM
1	failure	excellent	excellent	failure
2	good	fair	fair	fair
3	excellent	defeat	superior	defeat

In this situation, the friendly commander created a matrix based upon limited available information regarding his opponent; specifically he only knew his enemy's capabilities, but not his intentions. The friendly commander, in this case, developed

three possible friendly and enemy courses of action (COAs); natu-
rally, he could have developed more or fewer COAs. He then esti-
mated the effect of enemy capabilities on the probability of suc-
cess of each of his possible COAs. Haywood identified possible
payoffs--or degrees of predicted friendly success, given each
enemy COA--as superior, excellent, good, fair, failure, and
defeat.27

The friendly commander's problem is to choose the COA that
has the best chance of success. He expects that his rational
enemy will try to do the same. Since he does not know what the
enemy intends to do, and vice versa, the friendly commander can
only make a decision based upon enemy capabilities. Given only
enemy capabilities, the friendly commander cannot determine which
of his COAs has the best chance of success, because he lacks suf-
ficient information about his enemy to do so. Being conserva-
tive, the friendly commander scans his matrix looking for his
worst case result for each enemy COA. However, the friendly com-
mander does not want to be overly cautious, so he picks the best
of the worst cases, thus "maximizing his minimums" (maxi-min).28

Von Neumann and Morgenstern viewed the maxi-min model as a
less than optimum solution for selecting COAs. They believed
that a friendly actor making decisions that are dependent upon an
opponent's capabilities must make the first COA decision. His
opponent could then gain an advantage by developing a counter-
move. Haywood agreed with this belief, noting that,

> Decisions based upon enemy capabilities require us to view
> the situation from our perspective only. We then
> assume . . . we are deciding first, for we do not know which

enemy course of action our opponent might select.
Selecting . . . first gives us a significant disadvantage.[29]

Haywood, however, describes a second type of decision-making process, one where the commander visualizes the situation from the enemy's point of view, determines enemy _intentions_, and develops an optimum COA to counter it. As another example, Haywood developed the sample table, shown in Figure 2.

Figure 2

ENEMY COURSES OF ACTiON

FRIENDLY COA	I	II	III
1	failure	excellent	excellent
2	good	fair	fair
3	excellent	defeat	superior
MAX OF COLUMN	(excellent)	(excellent)	superior

This mini-max game considers reduced commander uncertainty but is still conservative. Here the friendly commander assumes the enemy commander made his decision first, because he has _indicators_ of that decision. For example, the friendly commander received reports that the enemy moved his command posts forward, massed his artillery units, and cleared passage lanes forward through his own minefields. These indicators of enemy activity have led the friendly commander to assume that the enemy _intends_ to attack; however he is not absolutely certain as to what the enemy _will_ do. He knows the enemy commander has three probable---and closely related--COAs, but does not know which one the enemy selected. Because he has indicators of what the enemy

will do--as opposed to what he can do, the friendly commander optimistically selects, for each enemy COA, a COA that will give him his best "payoff." The maximum value of each column is the best outcome the friendly commander can imagine achieving against that particular enemy COA.

Thus, the friendly commander, by choosing a COA after the enemy has supposedly selected his, is in a position to choose the optimum COA. If the enemy commander selects COA I, for example, then the friendly commander selects COA 3, which is the best or optimum outcome against the opposing COA. On the other hand, because he is uncertain as to what the enemy will do, the friendly commander balances optimism with conservatism by choosing the "worst of the best" cases.30 The worst outcome the friendly commander, a conservative, can foresee is the minimum value of the maximums found in the fourth row.31 In this case, the friendly commander can choose either COA 1 or 2.

Decisions based upon intentions rather than capabilities give the decision-maker an advantage over an opponent. As Haywood puts it,

> Making decisions on the basis of enemy intentions indicates an outcome more optimum than one based on an estimate of enemy capabilities. The advantage of deciding second is significant.32

In summary, my review of game theory identified three required components of a game: rational actor, rational control, and the recognition of friendly and enemy actions (capabilities and intentions). However, with respect to the last criterion, selecting an optimum COA to thwart enemy actions depends more

upon knowing enemy intentions than knowing just capabilities.
Therefore, my third criterion now becomes recognition of friendly
and enemy intentions, vice actions, because recognizing intent
should provide the optimum solution. By using these components
as criteria, I plan to analyze current wargaming methods to
arrive at an answer to my research question.

III. HISTORICAL EVOLUTION OF WARGAMING

Before analyzing whether or not the U.S. Army's wargaming
method gives the optimum solution, a review of the historical
evolution of wargaming from the 1820's to the present can illus--
trate why wargaming has become such an important part of the
decision-making process.

Prior to the 1820's, decision-making was primarily a com-
mander's responsibility, and did not have much staff input.
Because officers varied greatly in professional ability, military
decisions were left to a few skilled individuals. Some command-
ers, such as Napoleon, used toy soldiers upon maps to visualize
how battles might be fought. The Prussians, however, conceived
the idea of developing professional staff officers who could
assist commanders in tactical planning. Thus, the wargame
evolved from the need to train better staff officers.33

The Prussians first produced a set of wargaming rules in
1824. The wargame focused on maneuvering units on a map. It
soon became a tool to help not only staffs, but also commanders
practice and sharpen their tactical skills by visualizing
battles from start to finish.34

By 1828, a young lieutenant named Helmuth von Moltke became

an avid fan of wargaming. Molke promoted the importance of war-gaming after he became the chief of staff in 1837.35 Wargaming continued as a tactics trainer until the 1860's, when the Prussians began using the game as an aid to decision-making. Prussian commanders studied tactical situations, arrayed and moved forces on maps, and then visualized the execution of various COAs in their heads. The commanders then selected the best COA for execution based upon the wargame results.36

The Germans impressed the world in 1870 with their swift victory over the French. As a result, many nations studied German successes and adopted German staff procedures, including war gaming. Wargaming soon became a favorite decision-making tool for many European armies between 1871 and 1914. The U.S. Army also borrowed the German decision-making process, but failed to describe how to use a structured framework to analyze COAs until 1910.37

Russian commanders also used wargaming for decision-making. A Russian wargame played in April 1914 visualized a Russian invasion of East Prussia. This wargame resulted in two Russian armies being separated by terrain--and subsequently defeated in detail. The lesson, however, was ignored because the two Russian commanders argued with the umpire over how fast the German opponent could countermarch. The umpire capitulated and slowed the German countermarch, which allowed the Russian commanders to mass on the German player and destroy his army. Later that year, the same two Russian armies, separated by terrain, suffered defeat in detail at the battles of Tannenberg and the Masurian Lakes.38

Wargaming declined in popularity after World War One, primarily due to the excessive manpower required to perform a wargame. Specifically, wargames had grown from simply being a decision-making process on a map into major field exercises with hundreds of controllers and additional staff participants.39 During this interwar period, however, the U.S. Army developed Field Manual (FM) 101-5 to help staffs conduct a logical investigation of battlefield information in order to arrive at the best COA for the situation.40 This manual focused on developing COAs, but did not mention how the staff should analyze them.

Despite the lowered level of interest elsewhere, wargaming continued to be popular in Germany. In the 1930's Adolf Hitler incorporated a wargaming process into his decision-making.41 Hitler demanded that German attacks be agonizingly wargamed to determine friendly COAs, enemy reactions, and resulting German variations to the basic plan. In 1939, the Germans wargamed their planned 1940 attack into France; by so doing, they rediscovered an important march axis through the Ardennes.42 During World War Two the Germans continued to wargame major operations such as "Sea Lion," the planned invasion of England. Hitler's generals believed in the wargaming process so much that they talked Hitler out of invading England after the wargame continually produced disasterous results.43

Since the end of World War Two, the German wargaming system has undergone many refinements, not only by Germany, but also by other nations as well. In Europe and the United States, decision-making using wargaming shifted from just being a map

exercise to including a formal analytical process. Using this logical process became both the norm and a necessity because rapid technological change and improved weapons lethality meant less time to make decisions. 44

In the 1950's, new decision-making techniques that employed game theory were developed to cope with the exponentially increasing flow of information. 45 Game theory, as discussed in the previous section, provided the structure for making wargaming a formal process within the decision-making cycle. In 195', U.S. Army FM 101-5 made it clear that commanders needed to visualize enemy COAs, and then reach decisions about how they would defeat those enemy COAs by using maps and military symbols as aids. 46

From the 1960's until today, numerous nations refined their decision-making processes by including wargaming. During this time, however, U.S. Army wargaming procedures differed from the European methodology.

While the European methods of wargaming remained primarily a commander's assessment of the situation, the U.S. Army process became a command and staff action. 47 For example, in 1968 the U.S. Army defined wargaming in FM 101-5 to be a method for the commander and his staff to visualize friendly and enemy COAs as the troops moved from current dispositions to the objective. 48 Later on, the 1972 FM 101-5 took a prescriptive approach. War-gaming would now be performed around a situation map, with the staff recommending three feasible friendly COAs for the commander to consider. 49 No mention was made as to how many enemy COAs should be considered.

The 1984 FM 101-5 eliminates some prescribed requirements
and--as did the 1972 version--cites wargaming as a method for
analyzing COAs. However, the 1984 version fails to describe how
to conduct wargaming. The Command and General Staff College
(CGSC) attempted to fill this void by publishing Student Text
(ST) 100-9 in 1989 and 1991. These non-doctrinal CGSC products
discuss the wargaming process, specify the rules of wargaming,
and delineate how a COA should be analyzed to produce the best
solution under the given conditions.50

In summary, wargaming began as a training device to teach
tactics to Prussian officers; however, it eventually transitioned
into a firmly ingrained decision-making aid. The reason for this
rise in importance is because wargaming helped commanders to not
only visualize possible battlefield events, but also better ana-
lyze the advantages and disadvantages of friendly COAs versus
enemy COAs. While European wargaming remains primarily a com-
mander's function, the U.S. Army's method is both a commander and
a staff procedure. Whether or not either method is more advanta-
geous than the other will be examined in the next section.
Finally, while FM 101-5 is not specific as to how one goes about
wargaming COAs, CGSC ST 100-9 does describe this process in
detail.

IV. CURRENT ANALYSIS

The purpose of this section is to analyze, using the pre-
viously identified criteria, the tactical wargaming processes of
the U.S. Army, Germany, Britain, and the Soviet Union. After a
short review of the U.S. Army decision-making process (detailed

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descriptions of the German, British, and Soviet division-level decision-making steps are in Appendix A), I will analyze each of the wargaming methods to provide a foundation for understanding the U.S. wargaming process. These analyses will determine an answer to my research question by 1) ascertaining how effectively the U.S. Army wargaming process analyzes COAs, and 2) whether we can learn anything from the way other countries wargame.

The U.S. Army Tactical Decision-making Process

The decision-making process begins with receipt of a new mission, either from higher headquarters or one deduced by analyzing the current operation. Army FM 101-5 and CGSC ST 100-9 stipulate four steps:

o **Mission analysis.** This is a command and staff action to gather facts, make assumptions, analyze the higher headquarters' mission and intent, and focus the staff for planning the mission. This step ends when the staff briefs the commander about the current situation. The commander then approves a G3-derived restated mission, which incorporates the essential tasks from the higher headquarters' mission and intent; and then issues planning guidance for developing COAs to accomplish the mission.51

o **Course of action development.** The staff now focuses on any information necessary for the commander to make decisions about COAs. The staff analyzes the current situation by computing relative friendly/enemy force ratios, arraying initial forces on a map, developing a scheme of maneuver that meets the commander's guidance (or if it cannot, the staff reports why it cannot), and preparing COA sketches and statements to help the

commander visualize each COA. The staff develops as many varied, feasible COAs as time allows, giving the commander as many options as possible from which to choose. The staff also considers whether or not the COAs are suitable and acceptable.[52] This step ends with the staff recommending COAs to the commander, who decides which COAs to analyze in the next step.

o Course of action analysis. The staff uses wargaming to analyze the COAs chosen by the commander. It analyzes each COA separately and then compares them using criteria established before the COAs were developed to determine the best option, given the current conditions. The "best" COA is the one that has the highest probability of success against the enemy COA of greatest concern to the friendly commander.[53] This step ends with the staff briefing the results of each of the wargames to the commander, followed by the staff recommending a COA for the commander's approval.

o Decision/execution. The commander decides upon a COA, followed by the staff preparing the order or plan to implement the selected COA.[54]

Given this overview of decision-making, the reader should now understand how a U.S. division commander makes his COA decisions. This understanding is necessary for comprehending the wargaming process and the role it plays today in the overall U.S. decision-making process.

The Wargaming Process

A brief examination of step three of the decision-making process, to see how COAs are analyzed, seems in order. A more

detailed explanation of each step is found in Appendix B.

CGSC ST 100-9 describes six wargaming steps for analyzing a course of action. These are:

o Gather the tools. "Tools" are aids for conducting wargaming. They consist of friendly situation information, the areas of operation and interest, the current enemy situational templates, and a map showing current friendly unit locations.

o List all friendly forces. All available assets and units that are available for the mission are compiled for use in the wargame.

o List the assumptions. Any information that is not known to be a fact--such as enemy strength--but is necessary for COA execution is incorporated into planning assumptions.

o List critical events and decision points. Critical events are tasks that are essential for mission accomplishment.55 An example is a passage of lines. A decision point identifies in time and space where a commander must make decisions. Decision points help to synchronize friendly assets to have the maximum effect upon the enemy.56

o Select a wargame method. ST 100-9 recommends three techniques: the avenue-in-depth, the belt, and the box. These methods organize the battlefield for analysis. The avenue-in-depth and belt techniques, while examining avenues of approach in great detail, are slow. The box technique focuses on only a specific area (such as a river crossing site), but is faster than the other two techniques. Each wargame method is more fully explained in Appendix C.

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o Select a technique to record and display the results. ST 100-9 recommends two methods to record wargaming results: the narrative and sketch note techniques. A detailed example of each technique is in Appendix D.

o Wargame the battle and assess results. The staff identifies tasks to subordinate units and visualizes a subordinate commander's use of forces to accomplish his tasks. The staff goes through the action-reaction-counteraction sequence--visualizing friendly actions necessary to accomplish a task, determining how the enemy might react to each action, and then creating counter-actions to check the enemy moves. The wargame continues until the entire friendly COA is analyzed. The staff then restarts the sequence using the same friendly--but now a different enemy--COA. Wargaming continues until all friendly and enemy COAs are analyzed.[57]

ST 100-9 notes that the wargame process should result in several findings. For example, the wargame process discovers branches to the plan. Branches are options for changing friendly dispositions, orientations, or directions of movement; and for accepting or declining battle. In other words, they give commanders flexibility.[58] Wargaming also helps identify additional tasks to maneuver units and estimates how long an operation might continue. This information assists in Combat Service Support (CSS) planning, helps the G2 plan intelligence collection requirements, and identifies COA advantages and disadvantages.[59] Finally, wargaming can help determine the risk associated with various actions during the action-reaction-counteraction

sequence. Although risk is only a "best guess," the staff should
continually assess the likelihood that a COA will not accomplish
either the mission or a critical portion of a mission.60

As soon as the wargame process ends, the staff uses pre-
viously developed criteria to compare COAs to determine the one
having the highest probability of success.61 Criteria are fac-
tors that pertain to the mission, enemy, terrain, troops avail-
able and time. They also consider such factors as commander's
guidance, critical events, and principles of war.62 Certain
staff officers construct a decision matrix--using their
criteria--to determine the advantages and disadvantages of each
COA from their particular viewpoint. An example of such a deci-
sion matrix is in Appendix E.

Each of those staff officers, led by the G3, then presents
his information to the others for consideration. The staff as a
group reaches a consensus on a recommended COA. If the staff
cannot agree, the chief of staff listens to the facts and decides
which COA to recommend to the commander.63

Armed with this overview of U.S. Army decision-making and
wargaming, I can now better analyze the wargaming process using
my three criteria.

o RATIONAL OPPONENT. I mentioned previously that a deci-
sion-making game must have a rational opponent, one who will
pursue a COA that will achieve his best interests. Accordingly,
ST 100-9 requires the wargamer to visualize the battle, starting
with initial unit locations and following a logical sequence of
friendly and enemy actions within the method (box, belt, avenue)

selected for organizing the area of operations. Furthermore, ST 100-9 specifically mentions that visualizing the battle means examining battlefield flow from the friendly perspective and estimating how the enemy might employ his forces within his _capabilities_.64 In this approach, the wargamer must think and act as though he were an enemy commander.

However, ST 100-9 does not say what expertise is required to "fight" as an enemy commander. Moreover, a wargamer may or may not be familiar enough with the enemy to adequately determine an opponent's reaction to a friendly action. A wargamer's lack of enemy expertise could skew the wargame results by under- or over-estimating enemy capabilities and assets. A key question that arises is: Can we have a wargamer who can realistically estimate and play enemy capabilities? One possible solution is ST 100-9's optional technique called "adversarial" wargaming, where the G2 plays the opposing commander.65 In this method, the G2--hopefully the "expert" on the enemy--must think and act as an enemy would under the given circumstances. However, this is not as simple as one might think, since the G2 might, in a contingency situation, be an expert on another enemy. Also, the doctrine for all potential enemies is not always available for study. In Desert Storm, as the 3d Army G2 put it, "[Enemy] template production was a major team effort."66

So what can we expect from the G2? Most G2s are trained in a process called thinking "red". This process, delineated in FM 34-3, _Intelligence Analysis_, means seeing the battle from the enemy's viewpoint.67 The G2 prepares himself for the wargame by

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asking such questions as what is the enemy's doctrine? what are his tactics? and how is he equipped?68 The G2 uses this checklist to develop a data base and personal mental framework to better assume the role of a credible enemy commander.

While any commander or staff officer can consider enemy capabilities during wargaming, the G2 usually has the most training to perform this function. Using the G2 as an "adversary" provides a more balanced wargame because he can best replicate enemy assets and capabilities.

My analyses of German, British, and Soviet wargaming show that their commanders all consider a rational opponent in a way similar to the U.S. Army. However, there is much less staff involvement. The German and British commanders use their G2s only to provide doctrinal enemy information; the G2s do not wargame ideas with the commander. The Soviet commander uses his chief of staff in lieu of a G2. However, the Soviet chief of staff, like the German and British G2s, does not participate in wargaming.69

The German, British, and Soviet commanders examine the battlefield from both a friendly and enemy view, and they consider which enemy COA is best from the enemy's perspective. Each commander assumes that his opponent will use his assets within his capabilities to achieve his purpose. European commanders then visualize moving their forces using maps or other aids, determine possible enemy reactions, and figure out friendly countermoves.70 While European commanders consider enemy intentions, the lack of a "smart adversary" can skew the wargaming results.

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In summary, ST 100-9 notes that wargaming relies heavily on tactical judgment and experience.[71] Perhaps the best we can expect is that experience with one threat will carry over to another, and that the personnel asked to replicate a rational opponent will have the time to fill in any knowledge gaps. Thus, while our wargaming method considers a "thinking" opponent, it appears as if our ability to meet this criterion depends on the amount of available expertise.

The European commanders consider the enemy in much the same way as the U.S. Army does. The difference, however, is that, as mentioned earlier, the commander analyzes COAs by himself. By not using an "adversary" during COA analysis, European commanders may unwittingly insert bias into their wargaming conclusions. If, however, they use a qualified intelligence expert to replicate an enemy commander during adversarial wargaming, they might have a fairer analysis, which could produce a more optimum solution.

o RECOGNITION OF FRIENDLY AND ENEMY INTENTIONS. Intentions, as mentioned previously, are COAs that have already been selected for execution. For example, the ST 100-9 wargaming process compares friendly COAs (capabilities) against enemy COAs (capabilities). The commander then choses the COA he wants to execute. By committing to a specific COA, he now intends to pursue the COA to meet his objectives. Thus, as in game theory, friendly intentions result from a commander selecting a COA and deciding to execute it.[72]

ST 100-9 then asks the wargamer to visualize the battle,

given what the enemy might do. The battlefield visualization
process begins with the staff initially comparing friendly and
enemy combat ratios. ST 100-9 views the comparison process as
necessary for drawing some conclusions about friendly and enemy
capabilities as they pertain to the tactical situation, but
offers nothing about ways to determine enemy intentions.73

Friendly and enemy capabilities are the COAs a unit can
undertake. ST 100-9 recommends having the division-level com-
mander and staff conduct a detailed study of available friendly
and enemy personnel and weapons systems to determine capabili-
ties. By current doctrine divisions maneuver battalions; there-
fore, the commander or staff considers all combat assets within
both friendly and enemy battalion-sized units that are available
for the upcoming mission in order to determine capabilities.74

Within the friendly division, the staff uses its reporting
system to gather the detailed information necessary to determine
friendly capabilities. The types of reports differ from unit to
unit, depending upon local tactical field standard operating
procedure (FSOP), but they usually include the commander's situa-
tion report, as well as personnel and logistics reports.75

Enemy capabilities, however, are determined by the G2
through the Intelligence Preparation of the Battlefield (IPB)
process. FM 34-3 describes enemy capabilities as COAs that the
enemy might take--attack, defend, reinforce, or retrograde. In
effect, capabilities describe "what the enemy can do, when and
where the enemy can do it, and in what strength the enemy can do
it."76

ST 100-9 specifically notes that calculating friendly and enemy capabilities is not precise because many factors are unknown about both opposing forces. For example, while the process of comparing force ratios does account for quantifying personnel and weapons systems, it is difficult to be absolutely sure at any given moment how many people or how much equipment is available for use by either side. Additionally, human factors such as morale and leadership cannot be quantified with any degree of accuracy. Thus, while ST 100-9 accounts for enemy and friendly capabilities, it is only an estimate for the staff to use in planning. The friendly and enemy capabilities data are then used in the wargaming process.77

In von Neumann/Morgenstern game theory, and as discussed by Colonel Haywood, the optimum solution is to base decisions upon enemy intentions because one gains an advantage by knowing which COA the enemy commander has chosen. How, then, does the friendly commander discover enemy intentions before he decides upon a friendly COA? Doing so depends upon "tactical judgment, experience, . . . time available, . . . enemy indicators [my emphasis], [friendly] commander fatigue, and the commander's personality and ability."78

Most division commanders probably have reasonable competency, good judgment, and get enough rest to make logical decisions about enemy intentions. I base this assumption upon personal observation of five Battle Command Training Program War Fighter exercises.79 It appears, however, that a commander's experience and enemy indicators are more important prerequisites

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for discerning enemy intentions.

ALPHATECH, a behavioral science research corporation, observes that experienced commanders make faster decisions because they ask the right questions to fill in enemy information gaps. The commander's questions focus the division intelligence collection effort on those priority enemy indicators necessary for command decisions. Inexperienced commanders have trouble conveying what is important; therefore, intelligence collection becomes diluted as the staff tries to find out everything.[80]

Moreover, the G2 has the problem of discerning enemy "truth," even if he receives focused commander intelligence priorities. Intelligence analysts get confusing indicators of enemy decisions due to enemy deception, random enemy activity, or the ever-present "fog of war." FM 34-3 recommends that, when confronted with conflicting indicators, analysts must determine enemy intent by weighting some enemy indicators more than others, since some are more "indicative" of intent than others.[81] The process for weighting indicators is in Appendix F.

As with commanders, intelligence analysts vary in their experience levels. An experienced intelligence analyst tends to quickly assess a situation and pick out key activities that indicate what the enemy intends to do. An inexperienced analyst waits longer to confirm an enemy indicator, and steals time from the commander by doing so.

However, no analyst can ever be absolutely certain that he is right. Consequently, the analyst's degree of uncertainty contributes to the commander's risk. FM 34-3 mentions that

uncertainty plays a key role in the evaluation of the enemy and the amount of risk accepted.82

Since neither the commander nor his G2 are absolutely certain of what the enemy intends to do, it appears wargaming depends upon how much risk a commander is willing to accept. ST 100-9 plays it safe by telling the friendly commander to base his COA analysis upon enemy capabilities, and then wargame all possible enemy options—as time allows. Thus, the friendly commander must choose his COA before he knows enemy intentions. By basing his decision upon enemy capabilities, the friendly commander commits himself to a strategy before he knows which COA the enemy is executing. This committal by the friendly force triggers indicators which the enemy commander can now use to select his optimum COA. On the other hand, if the friendly commander bases his decision upon enemy indicators, he in effect "knows" what the enemy intends to do, and thus can better counter an enemy move.

When a commander focuses his intelligence assets and has experienced intelligence personnel, he should discover enough enemy indicators to wargame a COA that will defeat the enemy's intent. On the other hand, a commander might fail to focus his intelligence priorities, might have poor intelligence sources, or may simply run out of time. In those cases it appears the best he can do is to prioritize enemy COAs based upon enemy capabilities, wargame as many options as time allows, and execute the best option under the circumstances once the battle begins. German, British, and Soviet commanders, meanwhile, also begin

their analysis of enemy COAs by looking at capabilities. Some
differences in these three processes, however, are worth noting.

The German commander uses enemy capabilities to formulate
his plan while continuing to try to discern enemy intentions
through indicators of enemy activity. He carefully arrays known
enemy and friendly force locations on a map and calculates
friendly-to-enemy force ratios within his area of operations.83
Once the German commander calculates friendly-to-enemy force
ratios, he mentally estimates friendly and enemy combat effec-
tiveness, or the ability of his and the enemy's forces to accom-
plish their missions. This process, performed solely by the
commander, relies heavily on his experience and judgment. How-
ever, the German army is confident that its commanders have the
expertise, ba 1 upon years of training and experience, to per-
form a credib effectiveness assessment. Once the combat effec-
tiveness assessment is complete, the German commander compares
the results with emy indicators. He then uses his judgment to
deduce what he believes are enemy intentions.84

Once the German commander deduces the estimated enemy
intent, he then selects the best friendly COA that he
believes--based upon his experience and judgment--fits the cur-
rent situation. Because the enemy intent is only an estimation,
the German commander must accept risk. His staff continues, how-
ever, to develop other options (similar to U.S. Army branches) in
case the commander is wrong. Once the commander makes the deci-
sion, however, the staff formulates and issues the operations
order.85

The British commander's estimate of the situation is almost identical to the German method, except his analysis is very methodical. The British commander determines friendly and enemy capabilities by analyzing "factors"--terrain, time available for a friendly decision, weather, comparison of forces, logistics, and morale. The British commander and his G2 focus their efforts on comparing each of the above factors against the purpose or "aim" that the friendly commander wants to achieve. Once the commander understands friendly and enemy capabilities, and the effect of the factors upon his accomplishing the aim, he moves into the next step--determining enemy options.86

In determining enemy options, the British commander now assesses each possible enemy COA by mentally visualizing what the enemy commander, given his capabilities, might do. This process is very similar to the U.S. Army method, except the commander does it without staff assistance. The British commander then tries to deduce the enemy commander's most dangerous COA, which is the one that impacts most upon friendly mission accomplishment. Deducing the enemy's "most dangerous" option is a product of the commander's experience and his judgment in using the information at hand.87

Once the British commander determines the most dangerous enemy option, he personally examines those COAs that attain the "aim". He mentally weighs the advantages and disadvantages of each COA against the enemy's most dangerous COA, and selects the best option available under the circumstances. The commander's weighing of advantages and disadvantages is based upon his

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personally chosen criteria. For example, he might favor a plan
that is simple, fast, and makes the best use of terrain. Once
the British commander selects the most advantageous option, he
briefs his staff as to why he selected it. The staff then pro-
duces and issues the operations order.88

The discussion of Soviet tactical decision-making proce-
dures within this paper addresses only known doctrinal methods
and capabilities. Recent political turmoil within the Soviet
Union makes it difficult, at best, to assess what capabilities
the Soviet Army has either lost or retained. Thus, while this
paper addresses Soviet decision-making in the present tense, it
is possible that Soviet methods might be under revision.

The Soviet commander first considers his mission, instruc-
tions from his senior commander, and factors such as available
decision-making time, the current friendly and enemy situation,
and the capabilities of his subordinate commanders. The initial
analysis of the current situation enables the Soviet commander to
begin a detailed—yet rapid—analysis of available COAs using
mathematical norms and scientific principles.89

Soviet commanders probably have the same experience and
judgment capabilities of any commander we have looked at so far.
However, the Soviet decision-making process differs from the pre-
vious processes by giving the commander charts and tables, called
"nomograms," to perform mechanical calculations that commanders
in the United States, Germany, and Britain do mentally or analyt-
ically. Nomograms, which are based upon World War Two statis-
tics, are designed to rapidly calculate the capabilities of

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friendly and enemy units. The commander's calculations include
determining the proper number of artillery pieces, tanks, people,
and aircraft necessary for the appropriate correlation of
forces—or what he needs to accomplish his mission.90 An example
of a nomogram is in Appendix G.

The Soviet commander then weighs his capabilities against
the enemy's capabilities, and chooses the best option for accom-
plishing his mission. The Soviet commander's criteria for weigh-
ing options, similar to his Western counterparts, are based upon
experience and judgment.91 After he chooses the final option,
his staff issues the order.

Soviet commanders, unlike their western counterparts, are
less concerned with determining enemy intentions because they
believe they have enough mass to overpower an opposing force.
The Soviets view being able to discern enemy intentions as
the ideal; however, time, deception, and other factors impact
greatly upon deducing enemy intent. The Soviets use their robust
reconnaissance and intelligence system to accurately template
enemy assets and deduce enemy capabilities; they then use mass to
offset this lack of battlefield certainty regarding enemy inten-
tions.92 In effect, mass substitutes for finesse.

To sum up, U.S. Army wargaming does not meet this criterion
because U.S. division commanders make decisions based upon enemy
capabilities rather than intentions. However, none of the other
countries meet the criterion either, for the same reason. The
problem lies with an inability to discern enemy intentions.

Time and the level of acceptable risk seem to impact most

upon COA analysis. Although commanders need time to read and confirm enemy indicators, they may not have enough time. There-fore, since sufficient time is not always available, a commander must accept risk by wargaming enemy capabilities, vice inten-tions, to reach a decision.

Moreover, success in deducing enemy intentions is highly dependent upon an experienced commander who clearly defines his priority intelligence requirements (PIR) and conveys them to his subordinates. If the commander fails to focus his intelligence collection assets, then it seems that the best one can do is to 1) base decisions upon enemy capabilities and 2) have options available to counter any enemy move.

The European commanders all base their decisions upon enemy capabilities. Consequently, their processes do not offer ways to improve our ability to deduce enemy intentions. However, the commander-driven wargaming process might be useful for reducing time to make decisions when using friendly and enemy capabili-ties. Moreover, Soviet-style nomograms might help staffs do rou-tine calculations faster before COA analysis begins, thereby allowing more time to be spent on wargaming.

o RATIONAL CONTROL. ST 100-9 identifies five wargaming rules the wargamer must observe.93 The manual does not define the term "wargamer," but ST 100-9 notes that staff members analyze COAs, thereby implying that staff members are wargamers.94 Rules, then, apply to staff members who "wargame". The rules discussed below appear to be von Neumann/Morgenstern's rigid form, in that they are "specified in advance."95

The first rule requires the wargamer to list advantages and disadvantages as they become obvious during the wargaming process. ST 100-9 fails to explain what "obvious" means, or to offer any method for recognizing what is an obvious advantage or disadvantage.

Army Research Institute (ARI) believes that the ability to recognize obvious advantages and disadvantages comes from recognition patterns established from years of practice in viewing events. Recognition patterns make it obvious as to what can be accomplished, what dangers exist, what critical cues must be monitored, and what expectations should be formed.[96] Thus, the ability to understand and recognize obvious advantages and disadvantages comes from experience and judgment.

The second rule asks the wargamer to remain unbiased, keep an open mind, and avoid influences by other staff officers or his own prejudices. This appears to be unrealistic. ALPHATECH finds that decision-makers weigh any evidence which supports prior beliefs more heavily than evidence which contradicts them.[97] ALPHATECH also finds that experienced decision-makers reduce bias by seeking information to disconfirm their beliefs. Less experienced decision-makers, however, seek information to confirm their beliefs, which increases bias in their decision-making process.[98]

Experience and beliefs affect wargamer bias. As ARI describes it, people "are poor decision-makers at best."[99] People are influenced by their past experiences, pre-conceptions of reality, and personal preference. Rules number one and two,

however, rely greatly upon experience and judgment. There-
fore, rules one and two seem to contradict each other.

Rule number three asks the wargamer to assess the feasibil-
ity of the COA to see if it meets mission requirements.100 The
wargamer is then asked to reject any COA that is not feasible. A
feasible COA is one that is "doable"--either you can or cannot do
it. A COA that "meets mission requirements" means it is suit-
able, or results in the desired effect. An acceptable COA means
the expected results are worth the estimated costs. If the COA
under consideration is not feasible, the wargamer throws it out.
However, if the COA is neither suitable nor acceptable, what does
the wargamer do? The rule does not cover this situation.

The wargamer needs criteria regarding mission requirements
to decide what is suitable and acceptable. Mission requirements
criteria come from the commander's intent, any command guidance,
and other instructions from a higher headquarters.101 The staff
determines these criteria during the mission analysis portion of
the decision-making cycle. Thus, if the wargamer understands the
mission criteria, then he should know how to judge the suitabil-
ity or acceptability of the COA. However, if the wargamer fails
to understand the mission criteria, he will have difficulty
assessing mission suitability and acceptability.

The fourth rule requires the wargamer to avoid comparing one
COA with another during the wargaming of the individual COAs.
Accordingly, the wargaming process assists in avoiding premature
comparisons of COAs by designating a comparison phase, which
occurs after COAs have been analyzed in isolation.102 The staff

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then compares feasible COAs to identify the one with the best chance of success.103 This rule appears to be enforceable, provided that the wargamers have enough discipline to avoid early COA comparison.

The last rule requires the wargamer to avoid drawing premature conclusions and then presenting facts to support those conclusions. Unfortunately, ST 100-9 offers no help in suggesting ways to elude this problem. Premature conclusions occur if a situation seems similar to past situations.104 However, an experienced wargamer will realize that each tactical situation is different and that he must analyze each situation independently of past experience. A less experienced wargamer makes a rapid decision based upon past experience, fails to analyze all the facts, and arrives at a premature conclusion. Because this rule requires experience and judgment, it is susceptible to the same failings as rules one and two.

The German, British, and Soviet decision-making processes do not address specific rules for wargaming. European commanders mentally visualize the execution of each possible COA using the decision-making steps in Annex 2. However, some of their decision-making procedures might be considered rules.

The German commander, for example, is required to follow three sequential steps in determining his comparison of forces. These steps are: compare friendly and enemy combat effectiveness, examine possible changes in relative strengths, and compare friendly COAs against their chances of success. I can find no specific guidance on how these steps are accomplished, or what

criteria constitute a "chance of success;" however, an interview
with a German officer confirmed the steps are done in sequence
and the commander's judgment determines the criteria for suc-
cess.105

The British commander must rigidly follow the sequential
decision-making process described in Annex A. This process is
supposed to help the commander follow a logical, methodical
thought process to accomplish his "aim".106

Finally, the Soviet commander must use nomograms.107 The
commander mentally visualizes the current situation, then selects
the nomograms which fit. However, selecting nomograms to fit a
situation is somewhat similar to free gaming, since the situation
constantly changes as to which nomograms are necessary to deter-
mine a tactical answer. However, because the data which produce
nomograms do not change, nomograms themselves are not only rigid
but probably antiquated.108 The process of choosing nomograms to
meet the requirements of a situation is very similar to a U.S.
Army "playbook." A playbook consists of pre-determined branches
to a plan, that are detailed enough to execute, if necessary.109
Thus, a Soviet commander, by choosing which "norms" fit the situ-
ation, takes a "playbook" approach toward analyzing the situation
he faces.

In summary, U.S. Army wargaming rules do not meet this
criterion because they are vague and conflicting. The rules
attempt to establish some general conformity, which is good; how-
over, wargamers must rely heavily upon experience and judgment to
comply with them. Wargamers must not only define unclear and

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conflicting rules but, by being human, the wargamers are subject to personal biases and are subject to making premature conclusions as well. More specific rules and clearly defined wargaming terms might help. Reducing wargamer bias and premature conclusions is difficult at best; however, ST 100-9 could be more specific on how a wargamer avoids these problems.

European rules are prescriptive guidance for following certain procedures during decision-making. However, since there are no specific rules associated with the mental wargaming process, I cannot make an assessment whether or not the European methods are better than ours.

V. CONCLUSIONS AND IMPLICATIONS

I began my research by asking, "Does the current manual wargaming process, as practiced by the U.S. Army, determine the optimum course of action for the tactical commander?" My investigation shows it does not—and probably cannot because of uncertainty. My overall findings are that while wargaming considers a rational opponent, it does not analyze COAs by considering enemy intentions, nor is rational control precise enough to preclude human bias and premature judgment. Furthermore, analyses of the current German, British, and Soviet processes demonstrate that their processes are probably no better than the U.S. Army's process. Besides my overall conclusion, some others are also worth mentioning.

First, wargaming relies upon experienced wargamers who understand the doctrine of a rational enemy. Therefore, lack of expertise about the enemy might bias the wargame results.

However, the G2 should be the staff subject matter expert on enemy doctrine; therefore, he must be able to provide the best possible information about the enemy.

Second, and closely related to the previous conclusion, the use of adversarial wargaming helps reduce the bias in wargaming results by incorporating the best possible representative of the enemy, the G2.

Third, game theory views recognition of enemy intentions as the optimum way to choose a friendly COA. However, in the "real world," getting the optimum solution is difficult because commanders are under such limitations as time, uncertainty, a possible unwillingness to take risk, and because they have difficulty formulating useful PIR. While the intelligence community does its best to help with these problems, divisions currently do not have the assets to produce the "near-real time" intelligence the commanders need to make decisions. 110

Fourth, we can learn from the German, British, and Soviet processes. The first lesson is that their processes require more commander involvement, which seems to reduce the time needed to analyze COAs. Accordingly, ST 100-9 recommends an option to shorten the decision-making process by involving the commander more when time is critical. 111 The second point is that the Soviets are particularly effective at simplifying staff calculations through the use of nomograms. While nomograms do not speed up wargaming, per se, they might assist in rapidly performing mission analysis so that more time is available for COA analysis.

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My final conclusion is that U.S. Army wargaming rules do not provide an effective structure for analysis; they are vague and conflicting. The rules rely too much upon experience; as such, they are subject to misinterpretation and bias.

Having reached some conclusions about wargaming, I can now deduce some corresponding implications. First, the G2 will need extensive training to replicate a rational opponent through adversarial wargaming. This concept should be taught in U.S. Army schools and units must practice it in the field. Second, we must do a better job training officers on the development of PIR. Because they focus the intelligence effort, PIR must be more than just a "check the block" requirement during training exercises. Third, the intelligence community will need to develop methods to provide commanders with near-real time imagery to help commanders deduce enemy intentions and reduce risk by answering the PIRs. These first three implications would seem to be my most important ones. Fourth, the U.S. Army school system should emphasize the concept of more commander involvement in wargaming in order to reduce COA analysis time. Fifth, we must look at the practical-ity of time-saving templates to ease the staff burden of comput-ing the data the commander needs for decisions. Finally, FM 101-5 needs to be rewritten to include the detailed wargaming process found in ST 100-9. Until FM 101-5 is revised, however, ST 100-9--which is not doctrine--will need to be revised to include the applicable changes recommended in this paper.

Helmuth von Moltke ("The Elder") said that, "You will usually find that the enemy has three courses open to him, and of

these he will adopt the fourth."112   Thus, no matter what the

commander does, he cannot escape uncertainty completely.   While

our wargaming process has its problems, it does provide a method

for helping the commander cope with this "fog of war."   However,

it can and should be improved, since the ability of a commander

to visualize and analyze friendly COAs against enemy COAs just

might be the deciding factor on the battlefield.

Appendix A: Selected European Army Decision Models
Reference: TRADOC Report _The Command and Control System of the German Army, 1977_, pps. 1, 2; and interviews with German CGSC students.

1. German Army. The German Army uses a five-step estimate of the situation. The commander may move between steps in no particular order.

    o Analysis of the mission. The commander and staff iden-
tify important tasks from the higher commander, any conditions or
limitations placed upon possible friendly courses of action, and
perform an analysis of the current situation.

    o Estimate of the Friendly and Enemy Situation. The esti-
mate of the friendly situation includes determining friendly com-
bat power and estimating friendly effectiveness. Combat power is
determined by staff estimates, normally personnel and material
strengths, equipment readiness, supply status, and current status
of command and control means (in-place communications and
liaison). The German commander also considers troop morale,
level of training, and the physical condition of his troops. The
G2 and the commander develop and analyze enemy courses of action
based upon possible enemy capabilities and the current enemy
situation. The German commander mentally visualizes what the
enemy commander is capable of doing, then compares capabilities
to known enemy locations on his situation map. The German com-
mander continually updates and analyzes the enemy situation
throughout the process.

    o Evaluation of Environmental Conditions. This step is sim-
ply terrain analysis, which may be combined with the step above.
Terrain is evaluated as favorable, conditionally favorable, or
unfavorable in relation to both friendly and enemy forces and
their equipment, weather, and previous use of chemical or nuclear
munitions.

    o Formulation of Own Courses of Action. The German com-
mander first compares his friendly force analysis against the
enemy force. He determines, in his judgment, which force is more
capable than the other. He then performs a projection as to what
possible enemy or friendly strength changes might occur that
could affect his mission. The German commander determines which
courses of action are feasible by mentally wargaming each pos-
sible course of action against each enemy course of action. He
discards non-feasible courses of action.

    o Comparison of Each Course of Action. The commander
evaluates each friendly course of action as to advantages vice
disadvantages using criteria he considers important (i.e. use of
time or deception). He then uses his judgment to select the best
one, and his staff prepares the execution order.

Appendix A: Selected European Army Decision Models (continued).
Reference: Organizational Handbook of the British Army, 1990,
pps. 2 to 7 and interviews with British CGSC students and British
and Canadian students at the Canadian Staff College 1990-91.

2. British Army. The British estimate is called an "Apprecia-
tion". There are five steps. The commander must finish one step
before he moves to the next.

    o Step One. The British commander and staff analyze the
current situation, guidance, and mission from higher headquar-
ters, and any assumptions which impact upon the plan.

    o Step Two. The commander specifies his "aim", or what is
to be attained. The aim is the crux of the appreciation; it must
be right or the entire process might be skewed. There is only
one aim. The commander deduces his aim by considering the cur-
rent situation, to include friendly and enemy forces, their loca-
tions, training status, equipment readiness, and the enemy's most
probable threat (i.e., ground attack, terrorism, to name a few).
The aim is never qualified by limitations; it must be attainable
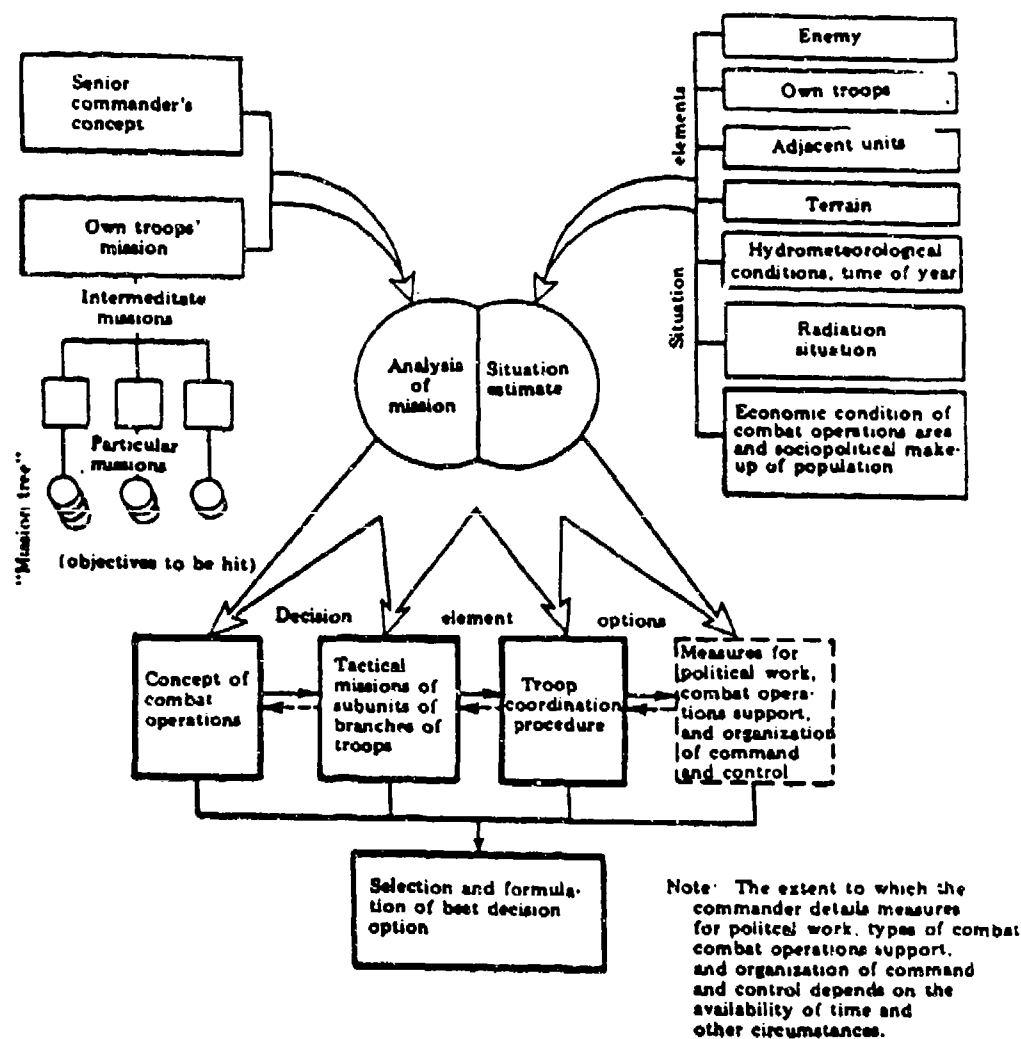given the means at hand.

    o Step Three. The commander considers all relevant fac-
tors--time and space, weather, comparison of forces, ground (ter-
rain), logistics, morale, and others as the commander's experi-
ence dictate. He then weighs each factor against the aim to
ensure that his aim is feasible, suitable, and acceptable (same
as U.S. criteria). He then considers all enemy courses of
action developed by his G. that might affect selection of any
friendly course of action. The commander considers enemy options
from his view point and how the enemy options might impact on his
attaining his aim. He then "worst cases" the situation and iden-
tifies the enemy's most dangerous or immediate threat.

    o Step Four. The commander considers all feasible courses
of action that attain his aim in relation to the most immediate
enemy threat. The commander mentally wargames each course of
action against the most dangerous enemy option to visualize his
plan and develop counterm s (b. 'es). Each friendly course
of action is considered separat ly, with the commander determin-
ing the advantages and disadvantages of each using his own crite-
ria (i.e. best use of ground, surprise, speed) in regards to
attaining the aim.

    o Step Five. The commander des which friendly course
of action, in his judgment, attai.. the aim. He briefs his staff
as to why he chose the course of action that he did and issues
guidance; the staff then prepares the order.

Appendix A. Selected European Army Decision Models (continued).
Reference: Fundamentals of Tactical Command and Control, 1977,
p. 188.

3. Soviet Army. The Soviet commander follows the process as
diagramed below.

Note: The extent to which the
commander details measures
for political work, types of combat
combat operations support,
and organization of command
and control depends on the
availability of time and
other circumstances.

Appendix B. United States Army Wargaming Process
Reference: United States Army Command and General Staff College
Student Text 100-9, Techniques and Procedures For Tactical Deci-
sionmaking, 1991, pps. 4-1 to 4-10.

     o Gather the tools. The commander decides, based upon the
G2's current situation estimate, which enemy course of action he
wants to wargame first. The staff then posts the map with the
area of operations, which came from higher headquarters. The
staff next posts the area of interest, as determined by the G2
from his Intelligence Preparation of the Battlefield (IPB). The
G2 posts the current enemy situational template, also derived in
the G2 IPB process, on the map. G3 personnel then post current
friendly unit locations on the same map as the enemy template.

     o List all friendly forces. The staff compiles all avail-
able forces, assets, and priorities of support such as air
sorties and nuclear/chemical packages. The list prevents over-
looking a resource during wargaming.

     o List the assumptions. In wargaming, assumptions help to
shape a course of action. Not everything is known as the course
of action is formulated; therefore, wargamers develop logical
assumptions concerning enemy activities, enemy strengths, and
other factors beyond friendly control. An assumption is consid-
ered valid, for wargaming purposes, if it answers the questions:
1) Is the assumption necessary to solve the problem?, and
2) Would the result change if the assumption were not made?

     o List known critical events and decision points. The G3
identifies critical events and decision points based upon the
current situation and/or commander's guidance. Critical events
are specified or implied tasks, the completion of which are
essential for mission accomplishment. Examples of critical
events are passages of lines, river crossings, and deep oper-
ations. Decision points identify events in time and space that
require a command decision to ensure synchronization. The war-
game process may identify additional critical events and decisive
points.

     o Select a wargame method. This means choosing from several
recommendations in ST 100-9 or using one of your own. Wargame
methods organize the battlefield so it can be analyzed by the
wargame process. ST 100-9 recommends three techniques: the ave-
nue-in-depth, the belt, and the box. The avenue-in-depth and
belt techniques, while detailed, are also time consuming. The
box method analyzes a small, critical area of the
battlefield--such as a river crossing site--and is faster. Each
technique may be used separately or in combination. A detailed
explanation of these techniques is found in Appendix C.

     o Select a wargame technique to record and display the
results. Recording the results of wargaming is a key factor in
synchronizing the battlefield. Wargaming results help determine

task organization changes, the maneuver sub-paragraph of the
operations order, and a course of action sketch, which becomes
the operations overlay. There are two recommended methods for
recording the wargame: the narrative and sketch note techniques.
The narrative technique describes the operation from start to
finish in "story" form. The sketch note technique uses brief
notes concerning critical locations and tasks. These notes might
be recorded on maps, a wargame worksheet, or on a synchronization
matrix. Examples are found in Appendix D.

o Wargame the battle and assess results. The crux of the
wargame process is the last step where the staff, led by the G3,
wargames the battle. The wargame process begins with the staff
identifying tasks to subordinate commanders one level down (bri-
gade), and assets two levels down (battalion). The staff men-
tally visualizes how a subordinate commander might use his allo-
cated forces. The staff simultaneously considers the subordi-
nate's use of combat, combat support (CS), and combat service
support (CSS) assets to accomplish assigned tasks. For example,
the division plans on tasking 1st Brigade to attack to secure an
objective. The staff mentally visualizes how the brigade com-
mander might array his combat, CS, and CSS assets to cross the
line of departure (LD). The staff next arrays unit symbols
depicting all the 1st Brigade assets on the wargaming map. This
process repeats itself for each of the division major subordinate
commands and division troops. The sequence of action-reaction-
counteraction now begins.

The division staff uses this sequence for any type of oper-
ation, but, as an example, I will use an attack. The staff
begins by first visualizing the brigades and their subordinate
battalions in their initial positions and then moving the repre-
sentative unit symbols on the map to the LD. The staff focuses
on those actions the subordinate units must take to accomplish
movement to the LD. The staff simultaneously considers all ele-
ments of the offensive framework (deep, close, rear, flank secu-
rity, and reserves to weight the main effort) and records all
actions taken by division and subordinate units across the
battlefield operating systems (command and control, maneuver,
fire support, intelligence and electronic warfare, mobility-
countermobility-survivability, combat service support, and air
defense) using a recording technique. Once each action is deter-
mined for moving to the LD, the second part of the sequence
begins--the enemy reaction.

The enemy reaction considers all possible enemy forces the
G2 identifies that could counterattack the division. It is
important to use all enemy assets available so the friendly
course of action can be adequately tested. The staff records
enemy actions on the same document as the friendly actions. This
leads into the third part of the sequence--the counteraction.

Appendix B: United States Army Wargaming Process (continued)

The staff now examines what actions the division headquarters takes in response to the enemy reaction. Some examples of counteractions might be shifting of priority of fires from one brigade to another or jamming enemy command and control nets. The G3 allocates assets to execute the counteraction and lists them in the same fashion as in the action and reaction sequence. The analysis of moving to the LD is now complete. The analysis continues in the same manner until the division reaches its objective. The process then restarts with a different enemy situational template but with the same friendly course of action. War gaming continues until all friendly and enemy courses of action are analyzed.

Appendix C. U.S. Army Wargame Methods.
Reference: United States Army Command and General Staff College
Student Text 100-9, Techniques and Procedures For Tactical Deci-
sionmaking, 1991, pps. 4-2, 4-3.

Step 5. Select a war game method. A number of techniques can be used to organize the area to be analyzed. Three possible methods are the avenue-in-depth techniques, the belt technique, and the box technique. These are explained below:

1. Avenue-in-depth technique. This technique focuses on one avenue at a time starting with the main effort. It is a good technique to use for offensive courses of action or in the defense where canalizing terrain exists.

2. Belt technique. This technique divides the battlefield into areas that run the width of the sector; it analyzes the subcomponent battles sequentially across the width of the sector. This is the preferred method as it ensures simultaneous consideration of all forces that could affect a particular event. The exact shape of the belt is based on analysis of the battlefield. Any belt may include more than one critical event.

In the offense, the planner considers the assault or penetration phase, the exploitation phase, and, finally, the pursuit phase. In the defense, he examines in sequence the battle in the covering force area, in the main battle area (MBA), and, finally, in the rear area. This technique is most effective when the terrain is broken into well-defined cross compartments. It

is also good to use if the operation is phased; includes amphibious assaults, river crossings, airmobile and airborne operations; or if the enemy is in clearly defined belts or echelons. Belts can be drawn adjacent to or even overlapping one another for complete visualization of the battle.
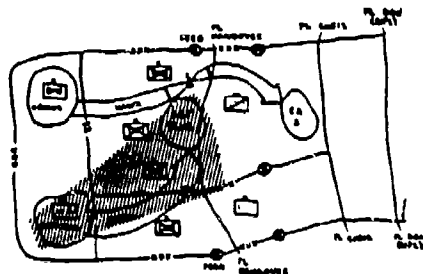
When time is short, a modified belt technique may be used. The modified technique, in both the offense and defense, divides the battlefield into not more than three sequential, but not necessarily adjacent or overlapping, belts that run the width of the sector and focus on actions throughout the depth of the area of operations.

As a minimum, the belts should include initial contact either along the line of departure (LD), line of contact (LC), or in the covering force area; initial penetration or initial contact along the FEBA; and passage of the reserve or commitment of a counterattack.

3. Box technique. The box technique is a microanalysis of a few critical areas, such as an engagement area, a river-crossing site, or a flank avenue of approach into the sector. The planner isolates the area and focuses the battle in that terrain area. This technique is less time consuming. An initial assumption is made that the friendly units can handle most of the situations on the battlefield and the planner can focus on the *most* essential tasks. This technique is useful if the task is apparent; e.g., attack or counterattack of a major enemy unit. This technique is used when time is extremely limited such as in a hasty attack.

You may use these techniques separately or in combination, or you may use your own method.
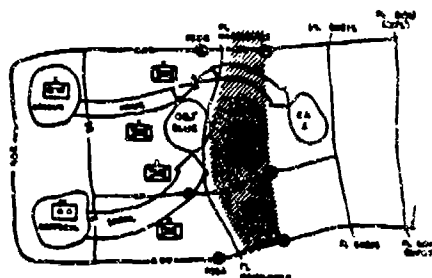
Appendix D. U.S. Army Wargame Recording Techniques.
Reference: United States Army Command and General Staff College
Student Text 100-9, Techniques and Procedures For Tactical Deci-
sionmaking, 1991, pps. 4-4 to 4-6.

NARRATIVE WAR GAME

CORPS DEFENSE

CRITICAL EVENT: Corps Counterattack—Box 1

As the follow-on tank division approaches the FLOT, the MBA units will both have fought significant fights but will be well disposed along the FEBA. The threat will probably commit the tank division along the avenue that has produced the most significant results. We feel that this will be along the avenue just to the north of the division-sep mech bde boundary. The MBA division may have sufficient combat power to defeat this tank division if the disruption efforts of the corps deep operations campaign have been successful. While we hope that this will be the case, we feel that the threat is most likely to penetrate our defenses vic Obj BLUE. The corps counterattack force, Div (-), will plan a counterattack to destroy any force making a significant penetration into this area. As this is the area where we feel the threat will more than likely come, we are well prepared for it by the initial placement of the counterattack force. The MBA division will support the counterattack by holding the shoulders of this penetration. The penetration will be shaped so that the div (-) attacks the southern flank while the MBA div blunts the penetration. At the conclusion of this operation, the corps will defend along the FEBA with the MBA div in the north, the corps counterattack force, div (-), in the center, and the sep mech bde in the south. Priority of engineer support to the MBA div to prep positions to hold the shoulders of the penetration, then to ensure mobility of the counterattack force. Avn bds be prepared to support counterattack into Obj BLUE. ADA priority to protecting the move of the counterattack force. IEW assets confirm the commitment of the threat into Obj BLUE, identify any follow-on forces.

WAR GAME WORKSHEET

Corps Defense

CRITICAL EVENT: Covering Force Battle—Part 1

Sequence	ACTION	REACTION	COUNTERACTION	ASSETS	TIME	REMARKS
1	Move into positions. Sensors dispersed for max protection. Monitor enemy nets. Locate CPs and FA units.	Conduct recon to find BPs and gaps in covering force units. Threat TAR from /rear and army.	Conduct counter-recon activities. Strip away army, div, & regt recon elements. Maintain listening silence. Emphasis on deception, building BPs, and FA positions for counterfire. Corps BAI program out to RIPL* slow 2d-ech forces.	ACR, maneuver bde, target acq btry, 6 FA bns, MI, ADA, engr assets.	H-36 to H-7	CFA must be perceived as MBA. FCS to ACR & DIVARTY, priority fires to MRLs, DAG, RAGs, Engr OPCON CF.
2	Prep for ground assault. Alert ADA systems for fixed wing & hel CAS. ID enemy air gd area.	Conduct FA prep on BPs, CPs, FA locations. Jam cmd, fire nets, and ADA warning system. Atk with fixed and hel C/S. Counter air program with air and ADA.	Loc FA firing positions and acts. CF and jam. Employ CA and ADA.	Tgt acq btry, MLRS, 6 FA bns, ADA FM per bn/regln, TAR, counterair.	H-7 to H Hour	Priority fires to MRLs, DAG, RAGs. ADA OPCON to CF. ADA coord w/regional AD plan.
3	Threat atks with 1 regt on ave A, 2 regts on ave B, 2 regts on ave C, 2 regts on ave D although sometimes forced to 1 regt. Threat tanks atk on aves B & C.	ACR hold on ave A, fight main fight on aves B & C. Maneuver bde hold ave D. Most forces lead dive to commit 2d-ech regts to ID main effort.	Economy of force on aves A & D. Coordinated atks on aves B & C. Heavy FA, CAS, & commitment of 2d-ech regts to force a breakthrough.	ACR, maneuver bde, 6 FA bns, CAS.	H Hour to H+10	CF must hold on aves A & D. Strong fight on aves B & C causes threat to deploy 2d-ech regts.
4	Threat commits 2d-ech regts of 1st-ech div on aves B & C. Cont economy of force on aves A & D.	ACR fights main fight on aves B & C. Corps control of CF fight difficult. Must now allow exposed flank between the 2 CF units. MBA units prep for handover.	Threat presses hard to form breakthrough. Attempt to find hes-lever and disrupt transition to MBA fight. Attempt to breach seam between ACR and maneuver bde.	ACR, maneuver bde, 6 FA bns, CAS, spt from MBA units.	H +10 to H +15	MBA units prep for battle handover. FA plans for displacement to MBA.

*reconnaissance and interdiction planning line (RIPL)—A phase line which defines the corps area of responsibility. The RIPL is drawn on the operations map to delineate the area forward of the corps fire support coordination line into an area for the corps to target BAI missions short of the RIPL and an area for the army group/allied tactical air force to target AI missions beyond the RIPL. (This is a NATO term only.)

SYNCHRONIZATION MATRIX-Division Offense

Appendix E.   U.S. Army Decision Matrix.
Reference: United States Army Command and General Staff College
Student Text 100-9, <u>Techniques and Procedures For Tactical Deci-</u>
<u>sionmaking</u>, 1991, p. 4-11.

CRITERIA[1]	wt[6]	COURSES OF ACTION[2]					
		1		2		3	
Simplicity	2	2[3]	4	1	2	4	8
Surprise	3	1	3	3	9	2	6
Speed	5	2	10	3	15	5	25
Mass	1	1	1	2	2	1	1
Combined Arms	1	3	3	4	4	3	3
Security	1	1	1	2	2	2	2
CSS	2	2	4	3	6	4	8
Objective	1	4	4	4	4	4	4
C2	1	3	3	2	2	3	3
Offensive	1	2	2	2	2	1	1
Total		21[4]		26		29	
Weighted total			35[7]		48		61

[1]Criteria are any factors that pertain to the mission (options include
specific elements of commander's guidance, battlefield operating
systems, tenets of AirLand Battle, OCOKA, critical events). They may be
assigned by either the commander or staff. If the criteria are
qualitatively the same for each course of action, they may not need to
be discussed.

[2]Courses of action are those that are selected for war gaming.

[3]The principal staff officers assign numerical values for each
criterion after the courses of action are war gamed. These values reflect
the relative advantages or disadvantages of each criterion for each course
of action. In the example above, course of action 3 is clearly the best.

[4]The numbers are totaled to provide a subjective evaluation of the
best course of action without weighting one criterion over another.

[5]Should the commander desire to emphasize one criterion as more
important than another, he assigns weights to each criterion based on
relative importance.

[6]The weights are multiplied by the initially assigned score in each
column.

[7]The scores are totaled to provide a "best" course of action based
on weights assigned by the commander.

Appendix F. Weighting of Intelligence Indicators.
Reference: United States Army Field Manual 34-3, <u>Intelligence</u>
<u>Analysis</u>, 1990, pps. 6-10 to 6-13.

WEIGHTING INDICATORS

Weighting indicators helps resolve ambiguity. In combat, intelligence analysts usually are confronted with conflicting indicators. Enemy forces may portray patterns associated with attack, defense, and delay simultaneously. Conflicting indicators result from--

* Deliberate deception.

* Bad execution.

* Temporary indecision.

* Transition between missions.

* Random activity.

* Incomplete or inaccurate information.

* Ambiguity of the indicator itself.

When confronted with ambiguous or conflicting indicators, analysts weigh some indicators more heavily than others to determine the enemy's actual intent. This is not a problem of simple mathematics. The enemy's actual course of action may not have the most indicators. Analysts develop a methodology for identifying those indicators which are most highly characteristic of a course of action. There are several techniques which, individually or in combination, assist in this process.

Origin of the Indicator

One technique of determining the enemy's intent is to consider the origin of the indicator; that is, the reason why the enemy force presents a particular pattern or tip-off. In brief, all indicators stem from either military logic, doctrinal training, organizational constraints, bureaucratic constraints, or the personality of the enemy commander.

<u>Military Logic</u>. Military logic implies, and military experts agree, that solutions to many military problems are obvious. For example, all modern armies employ artillery forward for attack and echeloned in-depth for defense. Violation of military logic usually implies the loss of combat power or support at some critical point during an operation.

<u>Doctrinal Training</u>. A nation's tactical doctrine includes military logic and much more. Most doctrine begins where military logic ends. Military experts sometimes disagree on the ideal solution to a specific military problem. For example, US and Soviet doctrine agree on deploying artillery forward in the attack, while they disagree on using artillery in a direct fire role. Just as terrain and weather are physical constraints on the enemy's adoption of a course of action, enemy doctrine and training are mental constraints. Soviet emphasis on detailed, repetitive training is designed to inbreed a sort of reflex action which enhances the value of doctrinal indicators. Though individual commanders display more or less

imagination and creativity in its application, indicators based on
doctrine and training are generally reliable.

Organizational Constraints. Organizational structure represents a special
case of doctrine. The ideal composition of a division (size,
organization, weapons, and organic support) is debatable. The military
experts have resolved this issue in radically different ways.
Organization influences include a nation's strategic commitments, economic
resources, geography, threat perceptions, historical experience,
alliances, personnel and equipment resources, and a myriad of other
factors. The tactical organization resulting from these factors causes
identifiable patterns to develop when employed. A US division generally
has three subordinate maneuver headquarters contrasted with four in a
Soviet division, and differences in the composition and structure of the
division base imposes distinct patterns concerning US and Soviet
operations.

Bureaucratic Constraints. Identifying bureaucratic constraints as a
source of indicators shows that military units are large organizations and
must establish routines and SOPs to function efficiently. This imposes
patterns in planning, execution, logistics support, and other activities.
Though there are general similarities in routines and procedures of
comparable units, there are likely to be significant variations which can
be identified and exploited locally.

Personality of the Commander. The enemy commander is the final source of
indicators. Each commander has a unique history of personal training,
experience, success, failure, and idiosyncrasies. Many are creatures of
habit, prone to repeat what has worked in the past; others are creative
and innovative. All are captives of their experience to some degree. It
is the commander who must apply and mix military logic, doctrine, and
organization to accomplish the mission. The commander's personality is
one major source of deviation from established doctrinal norms. The
importance of personality is recognized in that biographic intelligence is
a major component of strategic intelligence. US tactical OB doctrine
classifies personality as a subcategory under miscellaneous factors.

     In general, indicators are weighed, with the role of the commander
being considered a variable. In the case of a strong, innovative, or
eccentric commander (Patton or Rommel), personality is more important than
doctrine or training; while the personality of a methodical, traditional
commander ranks last.

Principle of Mass Indicators

     Another technique is to weigh the indicators which reflect or are
based on the principle of mass. Military units normally conduct deception
operations with the same force constraints in which they accomplish their
actual mission. The enemy commander often conducts deception with the
least outlay of scarce resources. Indicators based on a major confirmed
commitment of combat resources are more likely to reflect the true
situation. In a nuclear environment, massing is not required to achieve a
favorable combat power ratio; thus, mass is not a reliable indicator.

Analysts identify the enemy's capability to concentrate fires of potential nuclear delivery systems.

Other Indicators

The last technique is to weight those indicators which are most difficult to fake.

Quantify Probable Relationship. Quantify the probable relationship between the presence of specific indicators and the enemy's adoption of a particular course of action. If the enemy commander intends to adopt a particular course of action, what is the probability that a specific indicator is present? The answer is subjective, but it is based on the analyst's knowledge of and experience with the enemy, the analyst's professional judgment, and to some degree, the mathematical probability of specific indicators associated with enemy courses of action.

Analyze the Time Sequence of Events. It takes time for an enemy force to prepare, move, and execute an operation. Time, mass, and space relationships are a major tool in exposing deception. Since deception is often conducted with the least outlay of combat resources, close analysis of information from different sources which report on the same location, at the same time, or concerning the same enemy unit may reveal significant discrepancies.

Assess the Enemy's Combat Effectiveness. Such assessments are based on an analysis of both tangible and intangible factors. Tangible factors include personnel and equipment strength. Intangible factors include morale, training, political reliability, and other factors. While combat effectiveness bears directly on a unit's capabilities and probable courses of action, there is no scientific method of determining it. It requires the analyst's subjective judgment of the impact of both the tangible and intangible factors.

WARGAMING FRIENDLY AND ENEMY CAPABILITIES

Consider the enemy G2's perception of the friendly force. Though enemy capabilities exist independently of their assessment of friendly forces, the enemy's choice of alternative courses of action does not. Determine the enemy's perception of friendly capabilities through analysis of the collection capabilities, known collection activities, and inadvertent disclosures by friendly forces which might have been monitored by enemy intelligence. Detailed analysis of potential disclosure enables the analyst to partially reconstruct the enemy G2's working SITMAP.

Mentally wargame advantages and disadvantages of identified enemy capabilities from the enemy commander's point of view. This is a valuable analytical technique, but potentially dangerous if it becomes mirror-imaging.

Avoid preconceptions. The analyst must remember that the objective is not to prove a prior judgment. Experience suggests that preconceptions are the analyst's principal nemesis. Even if the techniques recommended

Appendix F.   Weighting of Intelligence Indicators (continued).

above are creatively employed, there is a danger that the analyst who has
reached and expressed a preliminary judgment unconsciously begins to seek
and weigh evidence which confirms the initial estimate and dismisses or
passes over inconsistent or conflicting information. The analyst should
not be concerned about the answer, as long as it is the right answer. The
analyst reserves judgment, maintains objectivity, remains aware of
uncertainties, tolerates dissent, and constantly tests working theory
against available evidence. Where practical, the analyst considers
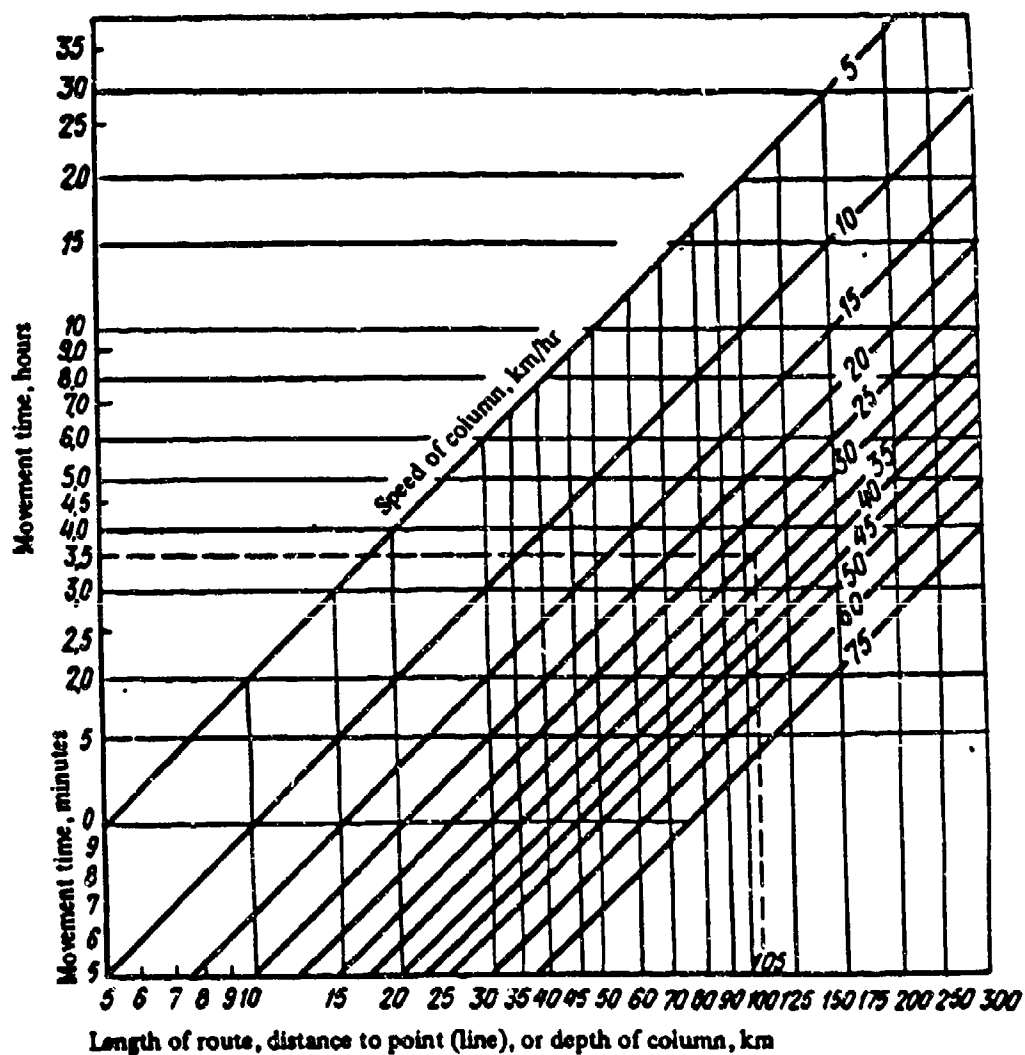establishing a "devil's advocate" system to test, challenge, and think the
unthinkable.

Figure 25. Graph for Determining the Required Time, the Extent of the Move, or the Troops' Marching Rate.

ENDNOTES

1. G.I. Gibbs, <u>Dictionary of Gaming, Modelling, and Simulation</u>, (Beverly Hills, 1978), 37. Gibbs defines decision-making as "taking" decisions, but the intent is the same.

2. Command and General Staff College, <u>Student Text 100-9, Techniques and Procedures For Tactical Decisionmaking</u>, (Fort Leavenworth, KS, 1991), 1-1.

3. The Joint Chiefs of Staff, JCS Pub 0-1 <u>National Defense Doctrine</u>, Washington, D.C., initial draft, 1 Nov 1989, I-10, and CGSC ST 100-9, <u>Tactical Decisionmaking</u>, p. 4-1.

4. Ibid, 4-1.

5. Ibid, 4-1. 6. U.S. Army, Field Manual 100-5, <u>Operations</u>, (Washington D.C., 1986), 22.

7. CGSC ST 100-9, 4-1.

8. John J. Fallesen, Rex R. Michel, and Charles F. Carter JR., <u>Analysis of Tactical Courses of Action Using Structured Procedures and Automated Aids</u>, (Fort Leavenworth, KS: Army Research Institute, [1989]), p. 5.

9. Frank C. Zagare, <u>Game Theory, Concepts and Applications</u>, (Beverly Hills, 1984), 7.

10. Ibid, 9.

11. Ibid, 7.

12. Ibid, 7.

13. Ibid, 7-8.

14. Ibid, 8.

15 John von Neumann and Oskar Morgenstern, <u>Theory of Games and Economic Behavior</u>, (Princeton, 1953) 12-20.

16. Gibbs, 103.

17. Martin Shubik, <u>The Uses and Methods of Gaming</u>, (New York, 1975), 18.

18. Ibid, 10. Shubik believes that chess and card games are rigid because the rules are specified in advance. As such the best game move for any given game turn is predictable due to the limited number of possible choices.

19. Von Neumann and Morgenstern, 12-16.

20. Zagare, 11-15.

21. Ibid, 11.

22. Ibid, 14-15.

23. Von Neumann and Morgenstern, 75-80.

24. Ibid, 76.

25. Colonel Oliver Haywood, JR. USAF, Military Doctrine of Decision and the Von Neumann Theory of Games, (Santa Monica: RAND Corporation, [1951]), pps. 2-6.

26. Ibid, 6-10.

27. Ibid, 20.

28. Haywood, 26.

29. Ibid, 23.

30. Alexander H. Cornell, The Decision-maker's handbook, (Englewood Cliffs: Prentice-Hall, Inc., 1980), p. 33. I designed the following table to better explain how decision-makers evaluate information to reach a decision.

PAYOFF MODEL

Absolute
Uncertainty

Enemy Capabilities

Enemy Intentions

Absolute
Certainty

(-)

(+)

P   P   P   P   P   P   P   P   P   P   P

Ultra
Conservative
Mini-Min

Maxi-Min

Balance
Point

Mini-max

Ultra
Optimistic
Maxi-Max

P= Payoff

For the payoff model above, absolute uncertainty and certainty are opposite poles. In decision-making theory, the absolutes are seldom used. An ultra-conservative decision has minuscule payoffs and is deemed inappropriate, while the ultra-optimistic decision fails to consider losses and is overly audacious. Thus, decision-makers tend to balance between being too conservative and too bold. Which side of the balance point one uses depends upon available information regarding an opponent. For example, if all one can discern are enemy capabilities, then most decision-makers choose the best of the worst cases by using the maximin model, or somewhere between ultra-conservative and the balance point. The subsequent payoff is not as good when compared to a decision using intentions, but it is safer due to limited enemy information. In this case, moving further to the right not

only increases risk but also a theoretically more positive pay-
off. On the other hand, a decision-maker who deduces enemy
intentions chooses the mini-max model, accepts a reduced but
larger payoff--but is still conservative in that he retains
assets to deal with some uncertainty. If he is more optimistic,
the decision-maker can move further to the right and increase his
payoff (while increasing risk), or move further to the left,
decreasing simultaneously both his payoff and his risk. Of
course a decision-maker can ignore the models completely and be
ultra-conservative, ultra-optimistic, or anything in between
regardless of how much enemy information he has. Choosing to
ignore the models depends upon the decision-maker's experience
and judgment, and how much risk he is willing to accept.

31. Haywood, 30.

32. Ibid, 24-26.

33. Staff of Strategy and Tactics, War Game Design, (New York,
1977), 2.

34. Ibid, 2.

35. Ibid, 4.

36. Ibid, 5.

37. Rex R. Michel, Historical Development of the Estimate of the
Situation, (Leavenworth: Army Research Institute, October 1990),
3.

38. Staff of Strategy and Tactics, 5.

39. Ibid, 5.

40. Michel, 7.

41. Staff of Strategy and Tactics, 5.

42. Ibid, 6.

43. Staff of Strategy and Tactics, 9.

44. Martin Van Creveld, Command In War, (Cambridge: Harvard Uni-
versity Press, 1985), pps 2-5.

45. Ibid, 3.

46. Michel, 7.

47. Ibid, 10.

48. Ibid, 8.

49. Ibid, 10.

50. ST 100-9 mentions being able to "read the battlefield" on page 2-1, and specifically the "best" course of action on page 4-1. The discussion on these pages indicates that commanders make decisions based upon current conditions that are known or assumed.

51. CGSC ST 100-9, 2-1 to 2-6.

52. Ibid, 3-1 to 3-6.

53. Ibid, 4-1.

54. Ibid, 5-1 to 5-2.

55. Ibid, 4-1.

56. Ibid, 4-1 to 4-2.

57. Ibid, 4-8.

58. Ibid, 4-8.

59. Ibid, 4-10.

60. Ibid, 4-10.

61. Ibid, 4-10.

62. Ibid, 4-11.

63. Ibid, 4-11.

64. Ibid, 4-7.

65. Ibid, 4-7.

66. BG(P) John F. Stewart, Desert Storm, The Military Intelli-gence Story, (Headquarters, 3d U.S. Army, April 1991), 13.

67. Department of the Army, Field Manual 34-3 Intelligence Ana-lysis, Washington D.C., March 1990, p. 5-6.

68. Ibid, 5-9.

69. D.A. Ivanov, V.P. Savel'yev, and P.V. Shemanskiy, Fundamen-tals of Tactical Command and Control, trans. U.S. Air Force (Washington: Department of the Air Force, 1977), p. 163.

70. My information for this footnote appears in a number of sources. My primary German source is a Training and Doctrine Command Report on The German Command and Control System, 1977. I used various interviews with German CGSC students as well as my

over seven years of USAREUR service working frequently with German units. During 1986 I was a company commander attached to a German armored battalion where I watched this process in action over a one-week period. My British notes come from interviews with British CGSC students, a British student I met in 1991 on a visit to the Canadian Staff College, and the 1986 version of the Camberley Staff College manual <u>Tactics</u>. The Soviet method comes from a USAF translation of <u>Fundamentals of Tactical Command and Control</u>, 1977.

71. CGSC ST 100-9, 4-1.

72. Ibid, 3-2.

73. Ibid, 3-2.

74. Department of the Army, Field Manual 71-100 <u>Division Operations</u>, Washington, D.C., June 1990, p. 1-1.

75. I used these reports in my three years experience as a primary staff officer in a heavy division. As a Battle Command Training Program Observer/Controller I observed ten different U.S. Army divisions use the same methods for collecting data.

76. U.S. Army Field Manual 34-3, 6-1 to 6-2.

77. CGSC ST 100-9, 4-1.

78. Daniel Serfaty, <u>Toward A Theory of Tactical Decisionmaking Expertise</u>, (Burlington: ALPHATECH, Inc., October 1990), chapters 4-2 and 4-3.

79. I personally observed five division commanders go through the decision-making process during BCTP War Fighter Exercises between September 1989 and May 1990.

80. Daniel Serfaty, <u>Tactical Decisionmaking Expertise</u>, (Burlington: ALPHATECH, Inc., August 1990), p. 24.

81. U.S. Army FM 34-3, 6-10 to 6-12.

82. Ibid, 5-4.

83. Headquarters, US Army Training and Doctrine Command. <u>Periodic Report, Articles of Special Interest: The Command and Control System of the German Army</u>. Fort Monroe, VA, 14 July 1977, p. 2.

84. Author interview with a German officer during CGSC War Fighter 1991. I cannot give his name due to the CGSC non-attribution policy.

85. According to my German source, this is normal because war gaming "takes too long".

86. Camberley Staff College. Tactics. Camberley, England, 1986, pps. 1-1 to 1-7.

87. Interview with a field grade British officer during a Canadian Staff College exercise. I cannot use his name due to CGSC non-attribution policy.

88. Camberley Staff College, 1-6.

89. D. A. Ivanov, V. P. Savel'yev, and P. V. Shemanskiy, p. 185-186.

90. Ibid, 210.

91. Ibid, 207 to 209.

92. Ibid, 40-46.

93. CGSC ST 100-9, 4-1.

94. Ibid, 4-1.

95. Shubik, 9-10.

96. Gary A. Klein and Donald MacGregor, Knowledge Elicitation of Recognition-Primed Decision Making, (Fort Leavenworth: Army Research Institute, July 1988), p. 19.

97. Serfaty, Theory of Tactical Decisionmaking, p. 24.

98. Ibid, 24.

99. Klein and MacGregor, p. 19.

100. CGSC ST 100-9, 4-1.

101. Ibid, 2-1 to 2-6 and 4-11.

102. Ibid, 4-1.

103. Ibid, 4-10.

104. Serfaty, Toward a Tactical Decisionmaking Theory, 25.

105. This is similar to the U.S. process where the commander determines what is important and bases his decision on his criteria.

106. Camberley Staff College, 1-6.

107. Ivanov, Savel'yev, and Shemanskiy, 207.

108. Shubik, 9-10.

109. This playbook works well within the U.S. division. See LTG Charles Otstott, BG(P) Craig A. Hagan, and Major Melvin E. Richmond, "Battle Rhythm," _Military Review_ (June 1990): 14-26.

110. Brown, iii. BG(P) Brown specifically states that "[t]he Army needs to develop an imagery architecture to provide near-real time photography to commanders".

111. CGSC ST 100-9, 6-1.

112. Robert Debs Heinl, JR., _Dictionary of Military and Naval Quotations_, (Annapolis: Naval Institute Press, 1985), p. 80.

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